

Stand alone maze: when and how?

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Type of atrial fibrillation

- First diagnose AF
- Paroxysmal AF: self-terminating < 48h
- **Persistent AF: > 7d, cardioversion, drugs**
- **Long-standing persistent AF: > 1y**
- Permanent AF: accepted by patients

Treatment

- Medical treatment
- Catheter ablation
 - Ready for first-line therapy
- **Surgical treatment**
 - **Conventional**
 - **Minimal invasive maze**
 - **Hybrid procedure**

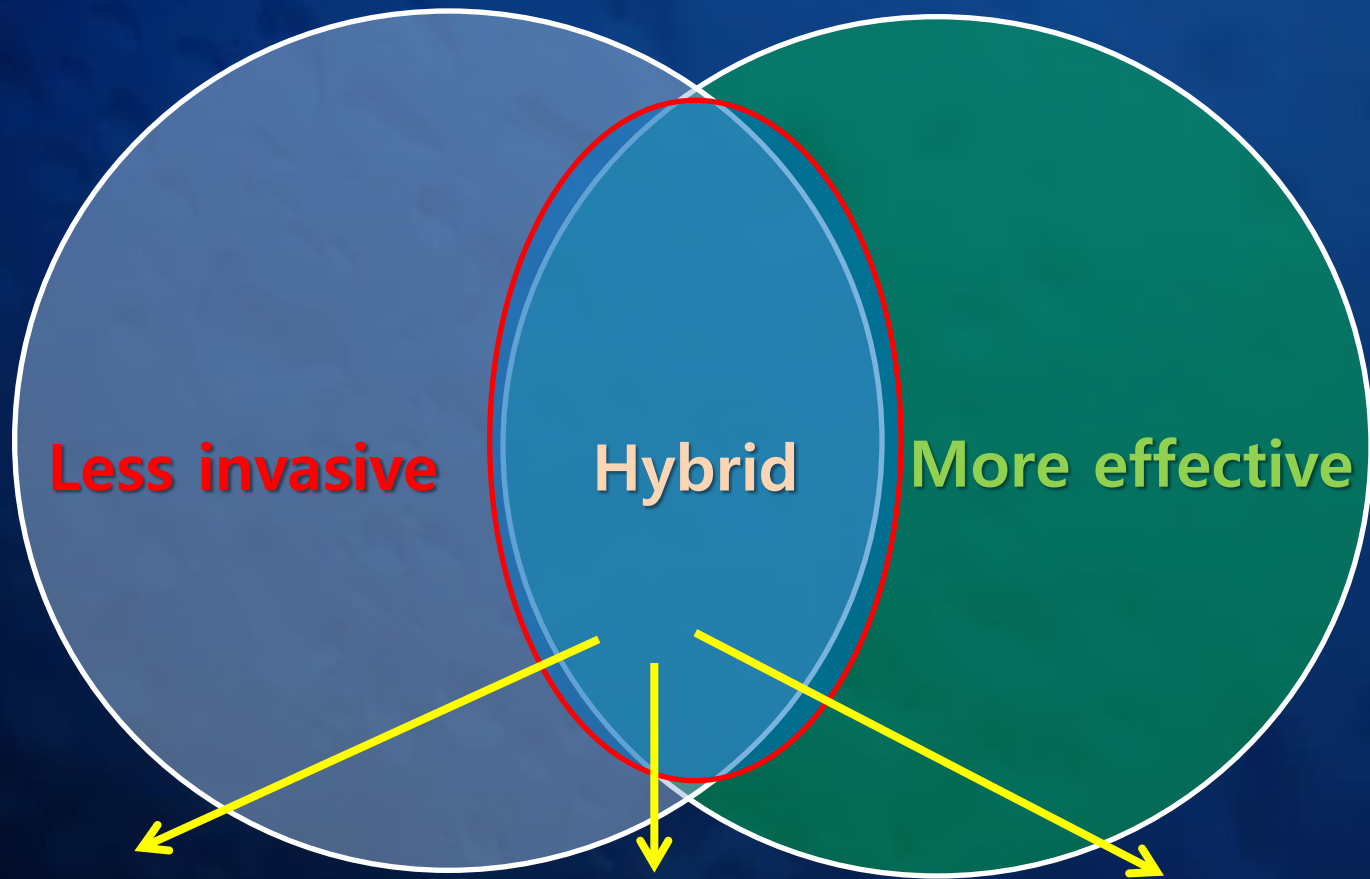
Surgical treatment

- The Cox-Maze III procedure
- The Cox-Maze IV procedure
- Minimal invasive surgery
 - **Bilateral thoracoscopic approach**
 - Right-side thoracoscopic approach
 - Right-side thoracotomy approach
 - **Exclusion/excision of the left atrial auricle**

Indications for surgery

- Based on the HRS/EHRA/ECA expert consensus statement
- **Symptomatic** AF patients
 - Who prefer a surgical approach
 - Who have failed one or more catheter ablation
 - Patients who have developed a contraindication to warfarin
 - Patients who will benefit from the elimination of LAA
 - Patients with a left atrial thrombus (contraindicated to catheter ablation)
 - Large left atria > 5cm (relative indication)

Ideal procedure



Sinus rhythm

No drugs

Atrial reverse remodeling

Effectiveness

Minimal invasive

Conventional



The Cox-Maze Procedure

Circulation
Arrhythmia and Electrophysiology



James L. Cox

The Cox-Maze Procedure: A Single-Center Experience Over 2 Decades

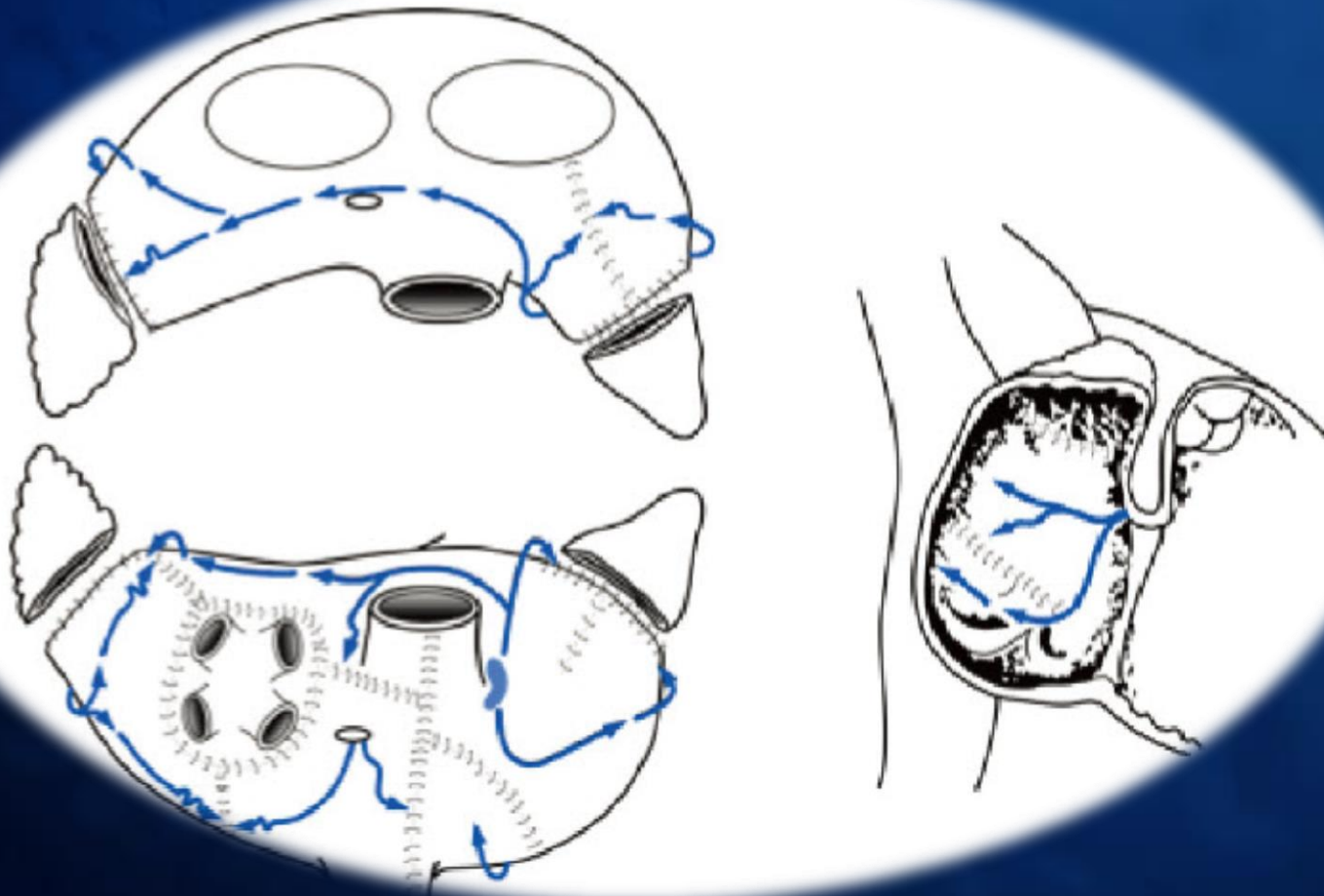
Timo Weimar, Stefano Schena, Marci S. Bailey, Hersh S. Maniar, Richard B. Schuessler, James L. Cox and Ralph J. Damiano, Jr

Circ Arrhythm Electrophysiol. 2012;5:8-14; originally published online November 17, 2011;
doi: 10.1161/CIRCEP.111.963819

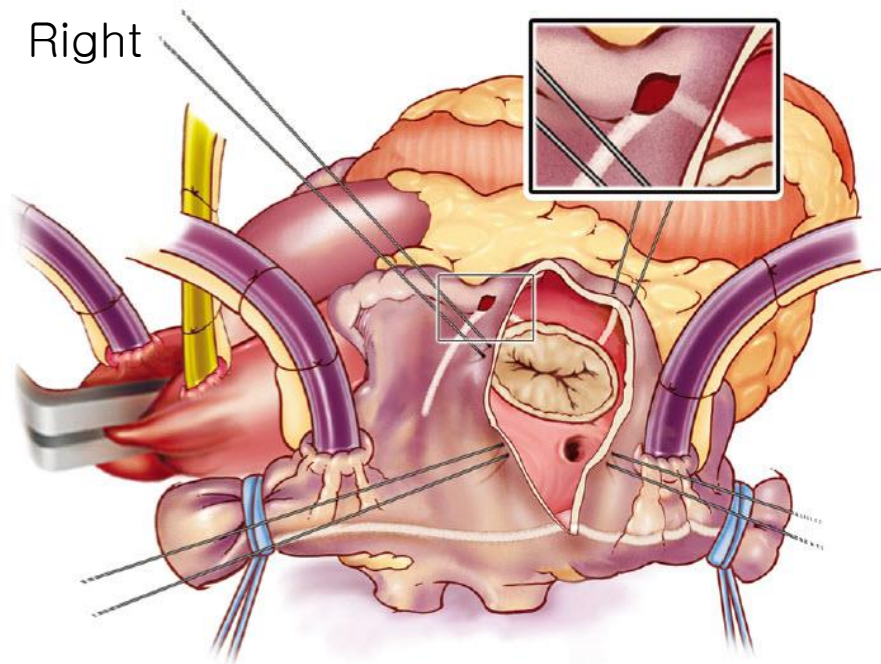
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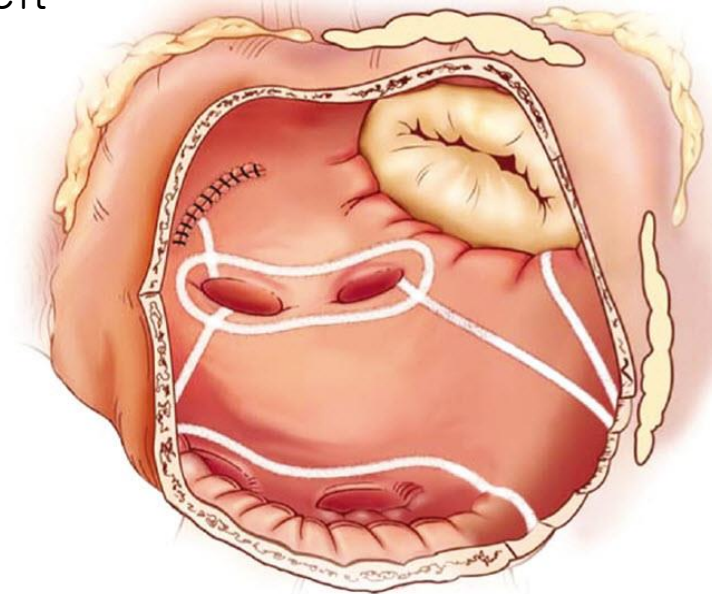
Cox-Maze III procedure



Cox-Maze IV procedure



Left



Results

Table 3. Late Follow-up

Variable	CMP III (n=112)	CMP IV (n=100)	CMP III+IV (N=212)
Follow-up, median (IQR), y	5.9 (2.5–7.8)	1.0 (0.74–1.9)	2.2 (0.9–6.2)
Freedom from AF*	96 (86–98)	90 (81–95)	93 (87–96)
Freedom from AF off antiarrhythmics*	83 (68–88)	82 (71–89)	82 (75–87)
Freedom from warfarin*	86 (75–92)	74 (62–83)	80 (72–86)
Late stroke (>30 d), no. (%)	1 (0.8)	0	1 (0.4)

*Data are given as mean (95% CI).

Risk

Table 2. Perioperative Variables

Variables	CMP III (n=112)	CMP IV (n=100)	<i>P</i> Value
CPB time, median (IQR), min	163 (145–183)	129 (113–150)	<0.001
CCT, mean (95% CI), min	90 (73.5–105)	39 (33.2–46.7)	<0.001
30-d Mortality	2 (2)	1 (1)	0.625
Early ATAs	38 (34)	40 (40)	0.732
Pacemaker implantation ≤90 d	9 (8)	7 (7)	0.776
Major complication rate	11 (10)	1 (1)	0.003
Reoperation for bleeding	3 (3)	0	...
Early stroke ≤30 d	1 (1)	1 (1)	...
Renal failure	2 (2)	0	...
Mediastinitis	1 (1)	0	...
Intra-aortic balloon pump	4 (4)	0	...

Minimally Invasive Stand-Alone Cox-Maze Procedure for Patients With Nonparoxysmal Atrial Fibrillation

Niv Ad, MD, Linda Henry, PhD, Ted Friehling, MD, Marc Wish, MD, and Sari D. Holmes, PhD

Inova Heart and Vascular Institute, Falls Church, Virginia

On pump via right mini-thoracotomy

Background. Catheter-based ablation for atrial fibrillation (AF) performed percutaneously is shown to be limited in patients with nonparoxysmal AF (non-PAF). The full Cox-Maze surgical procedure demonstrated good success with non-PAF, but concerns were raised regarding increased morbidity eliminating the effect of the success rate. This study assessed the safety and efficacy of a stand-alone on-pump Cox-Maze procedure for non-PAF.

Methods. Since 2005, 104 stand-alone Cox-Maze procedures for non-PAF were performed through a right minithoracotomy (6 cm) with femoral cannulation. Patients were monitored prospectively through our AF registry. Rhythm was verified by electrocardiogram and 24-hour Holter monitoring. Health-related quality of life (SF-12 Health Survey, Quality Metric, Lincoln, RI) and AF symptoms were assessed.

Results. Patients were a mean age of 55.9 ± 9.0 years, and 78% had long-standing persistent AF. Patient outcomes included no operative (30 days) deaths or renal

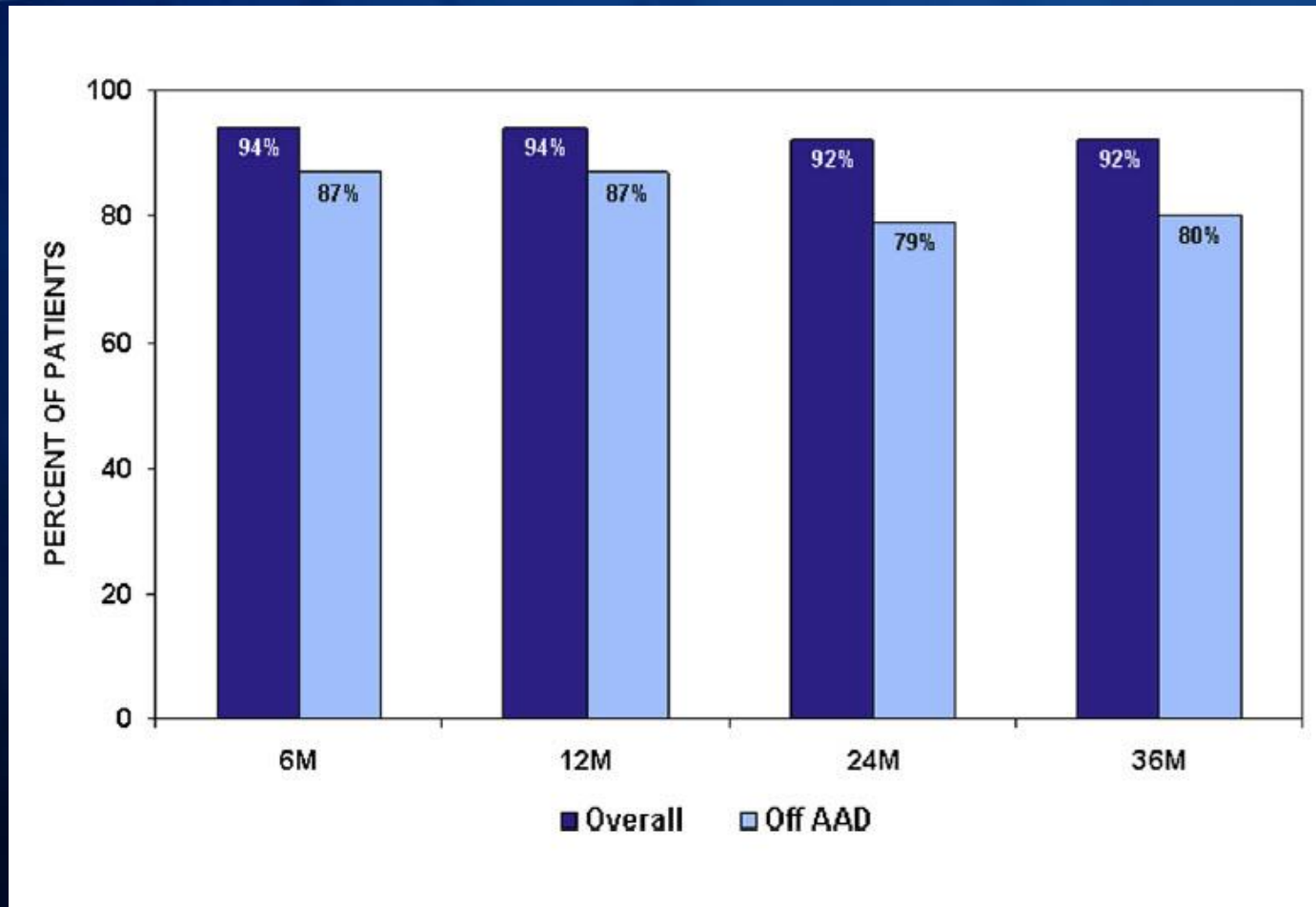
failure, 1 pacemaker, and 1 transient ischemic attack. The return to sinus rhythm at 6, 12, 24, 36 months was 94%, 94%, 92%, 92%, and off antiarrhythmic drugs was 87%, 87%, 79%, 80%, respectively. The success rate at 6 months after the initial 20 patients improved from 89% to 94%. Multivariate analysis found duration of AF predicted rhythm at 6 months (odds ratio, 1.15; 95% confidence interval, 1.01 to 1.31; $p = 0.04$). Significant improvement was noted for health-related quality of life and decreased AF symptoms at 1 year.

Conclusions. The long-term success rate after the Cox-Maze III procedure in a challenging group of non-PAF patients is acceptable. Our experience suggests the development of educational strategies to overcome the initial learning curve and patient selection criteria for AF surgical ablation.

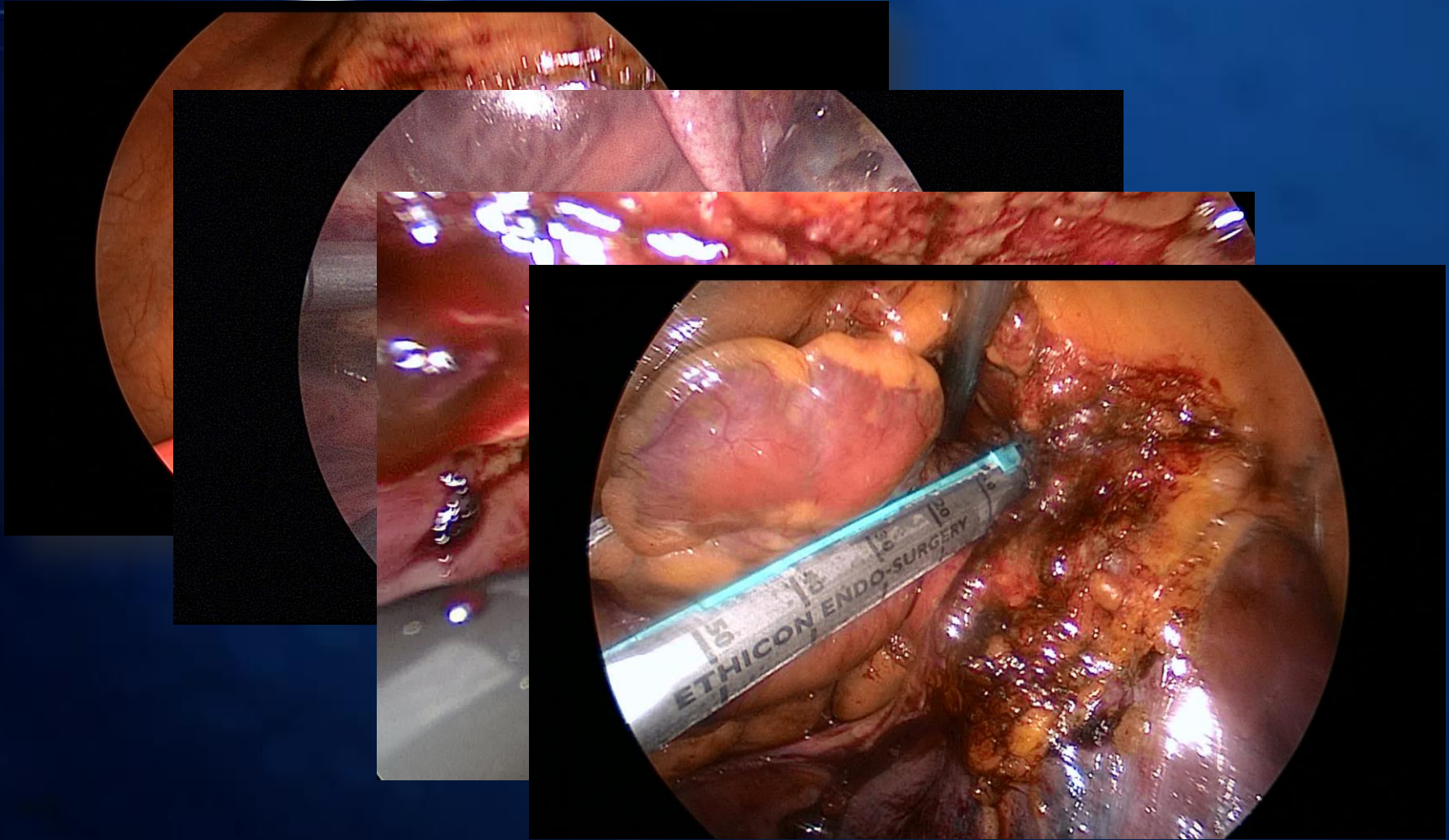
(Ann Thorac Surg 2013;96:792-9)

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Return to sinus rhythm

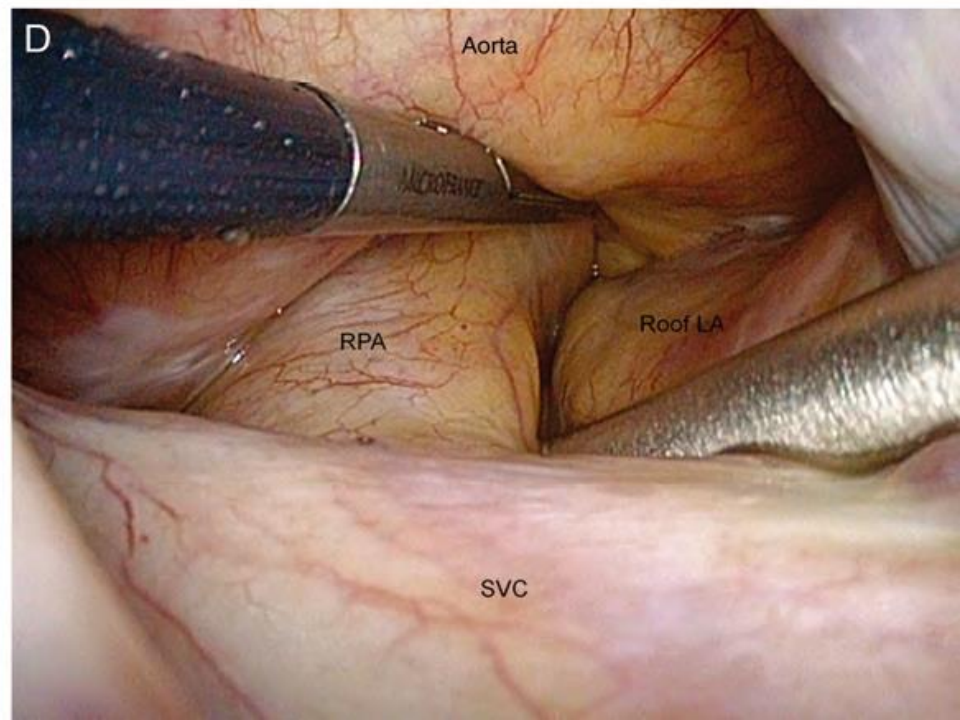
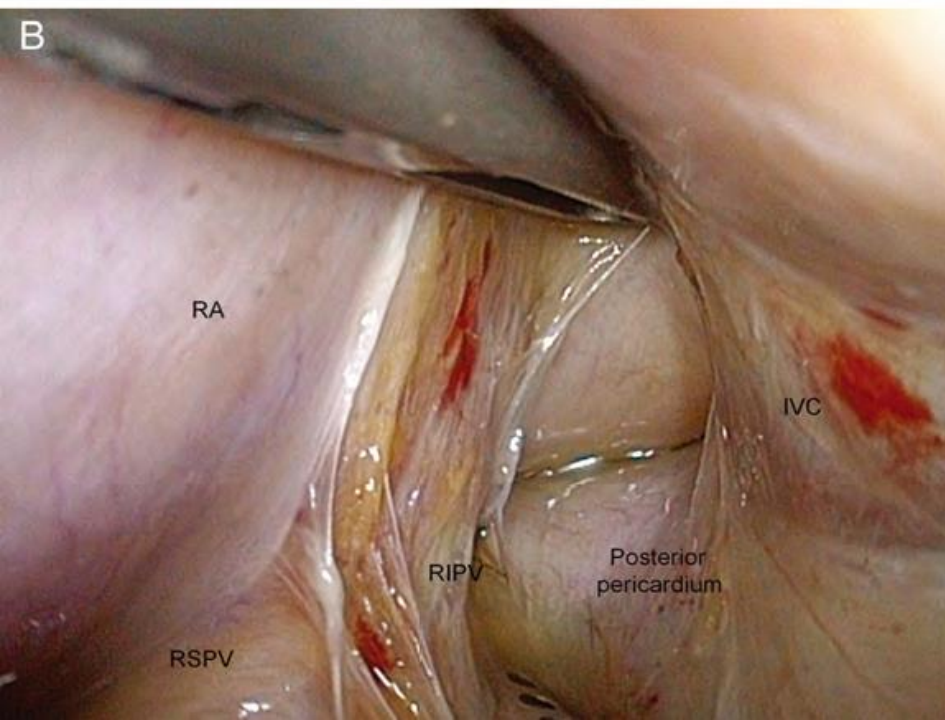
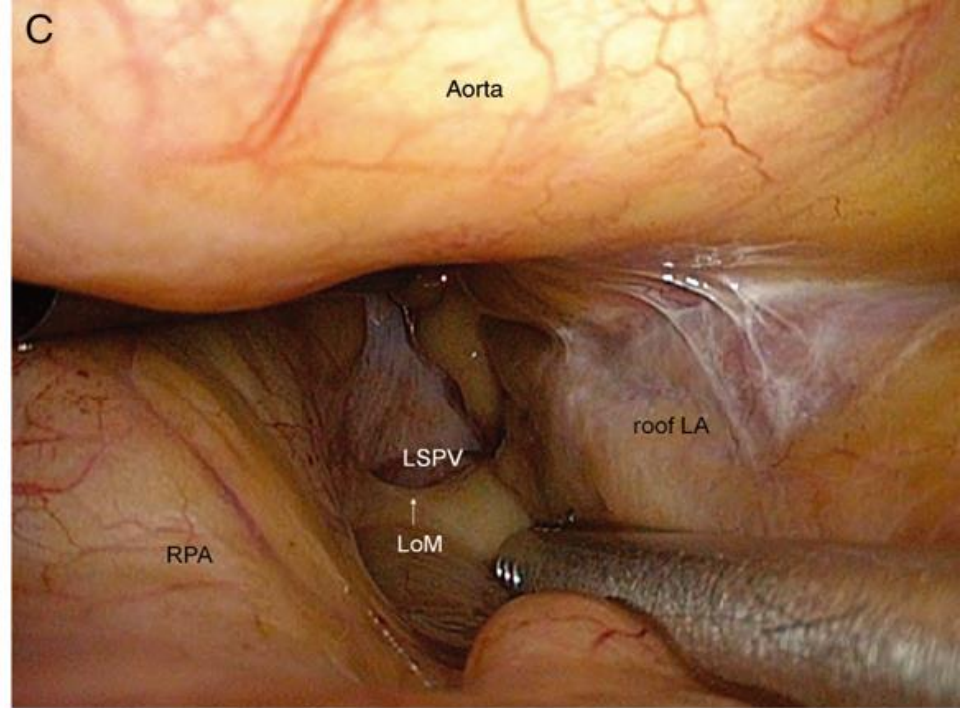
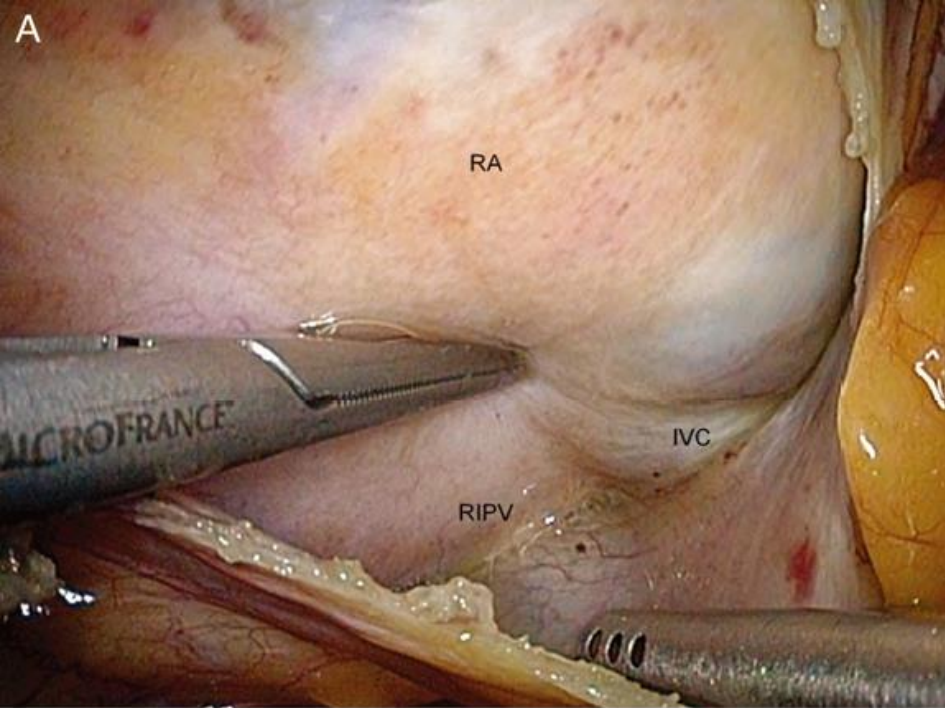


Total thoracoscopic ablation

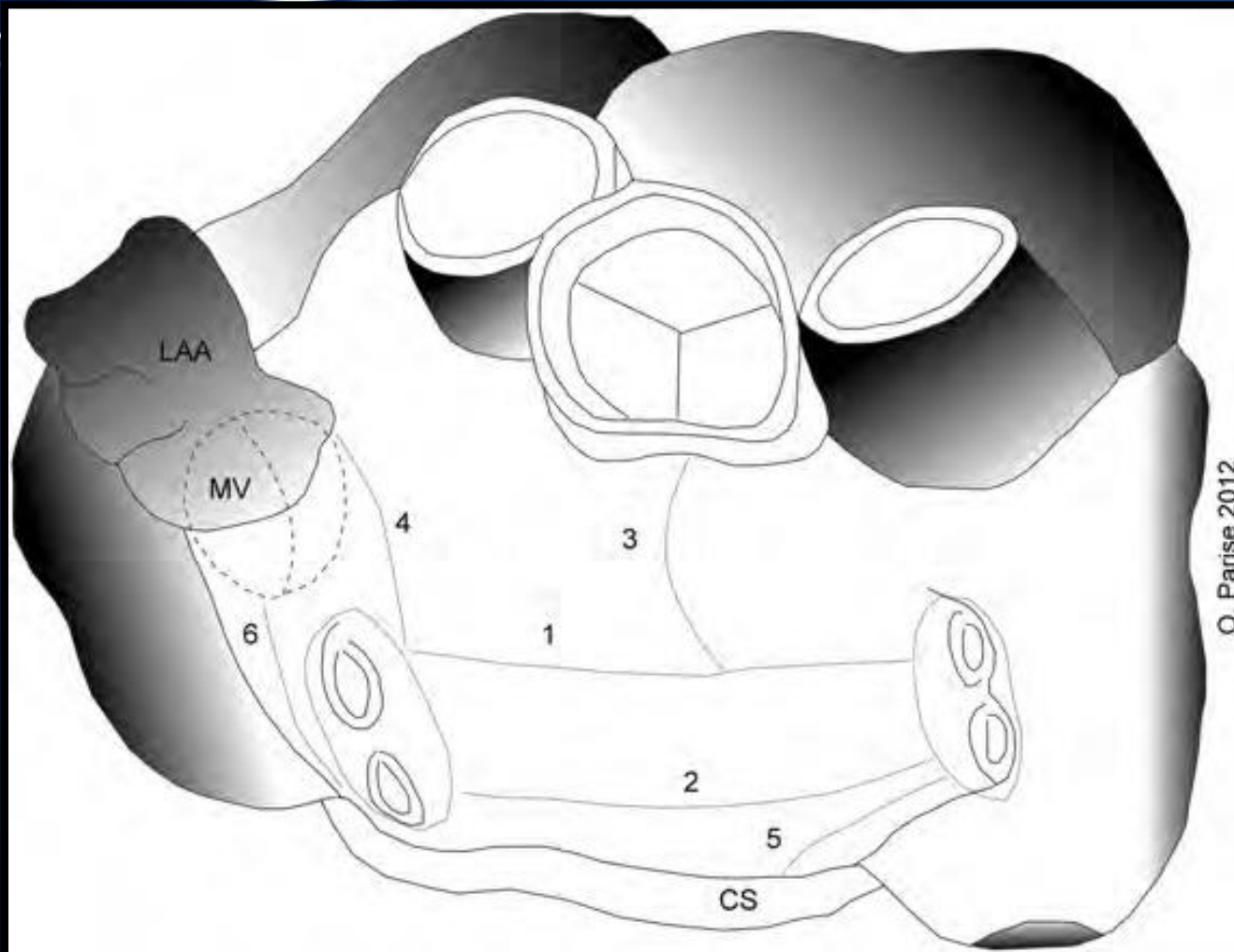


Thoracoscopic ablation

- Easy pulmonary vein isolation
 - **Bipolar: transmural**
 - Shorter time, narrow ablation lines
 - May result in early LA function restoration.
- Epicardial ablation
 - **Marshall vein, GP, Superior, inferior lines**
 - **LA resection**
 - Stapling, LA clip (several types)
- Minimal invasive (**3mm instruments**)



Ideal thoracoscopic ablation



Thoracoscopic maze procedure

Previous Studies With a Similar Surgical Technique

	Edgerton et al. ²	Krul et al. ^{4 a}	Sirak et al. ³
Type of study	Prospective	Prospective	Retrospective
Number of cases	30	31	32
Age (mean in years)	58	57	61.5
Gender; male (%)	86	81	65.6
Body mass index (mean)	NA	29 kg/m ²	NA
Diabetes mellitus (%)	NA	3	NA
Hypertension (%)	NA	32	NA
Stroke (%)	NA	3	NA
Duration of atrial fibrillation (years)	NA	8	7.7
Type of atrial fibrillation	Persistent	Paroxysmal (52%) or persistent	Persistent
Previous catheter ablation (%)	NA	45	12.5
Left atrial diameter (cm)	5.2	4.7	4.8
Mortality	0	0	0
Duration of hospital stay (median)	NA	6 days	NA
Conversion to sternotomy (%)	NA	10	3
Duration of monitoring	2–3 weeks	24 hours	1 week
Duration of follow up	6 months	1 year	6 months
Cases completed follow up (%)	100	71	75
Success rate (%)	58.3	86	87.5

^aAdditional ablation lines were done in persistent atrial fibrillation only (45%).

Hybrid Thoracoscopic Surgical and Transvenous Catheter Ablation of Atrial Fibrillation

Laurent Pison, MD,* Mark La Meir, MD,† Jurren van Opstal, MD, PhD,* Yuri Blaauw, MD, PhD,*
Jos Maessen, MD, PhD,† Harry J. Crijns, MD, PhD*

Maastricht, the Netherlands

- 26 consecutive patients
 - 42% with persistent atrial fibrillation
- 23% patients needed endocardial touch-up.
- 22 patients showed NSR at 1 year (holter)

PVI with GP ablation, LA resection

- 30 patients
 - 19 paroxysmal. 8 persistent, 3 long standing
 - Mean duration of Af: 79 months
 - Mean LA diameter: 42mm
 - 13 patients (43%) had prev. RFCA
- Freedom from Af (11.6 months)
 - Paroxysmal **84%**
 - Persistent **76%**
 - Long standing **33%**

SMC experiences



SAMSUNG

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Indications of our institutue

- Persistent atrial fibrillation
- Failed RFCA
- Contraindication to warfarin
- AF after ASD device closure
- Stroke history associated with AF
- Enlarged left atrium (>50mm)

Hybrid approach

Post-procedural confirmation



Admission



TTA

3 days



Transfer



EPS



Discharge

Simultaneous procedures



Admission



TTA



EPS

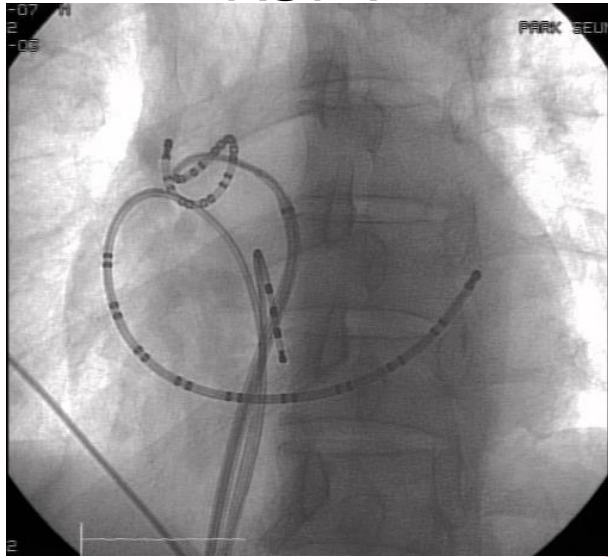


Discharge

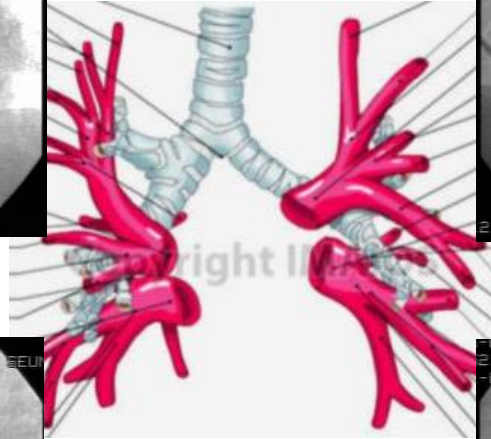
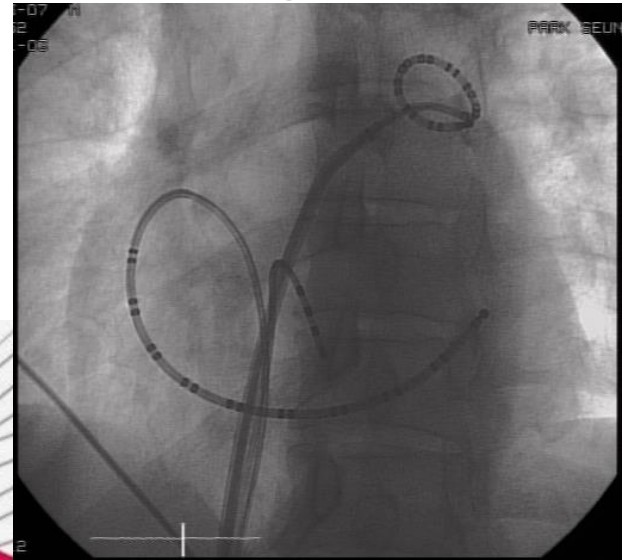
NEEDS HYBRID OR
Start. Dec 2014

Check previous PVI

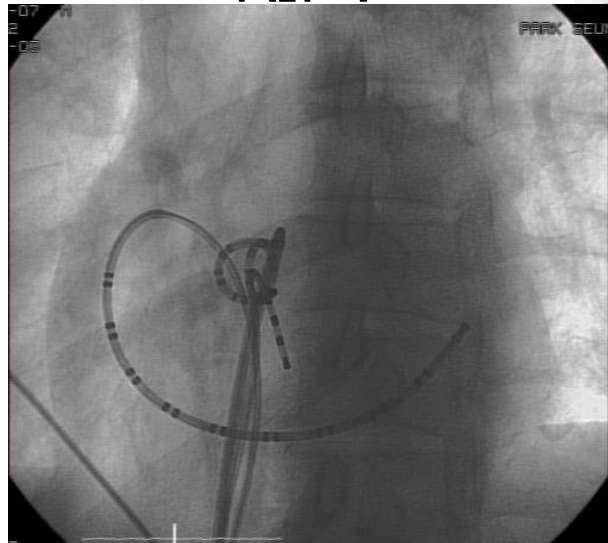
RSPV



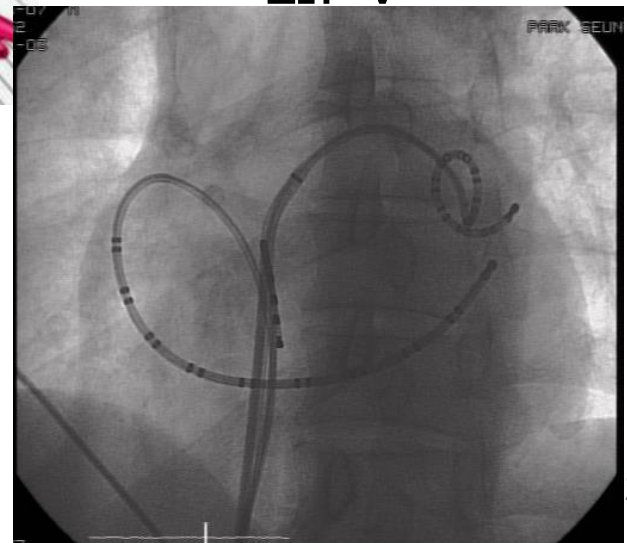
LSPV



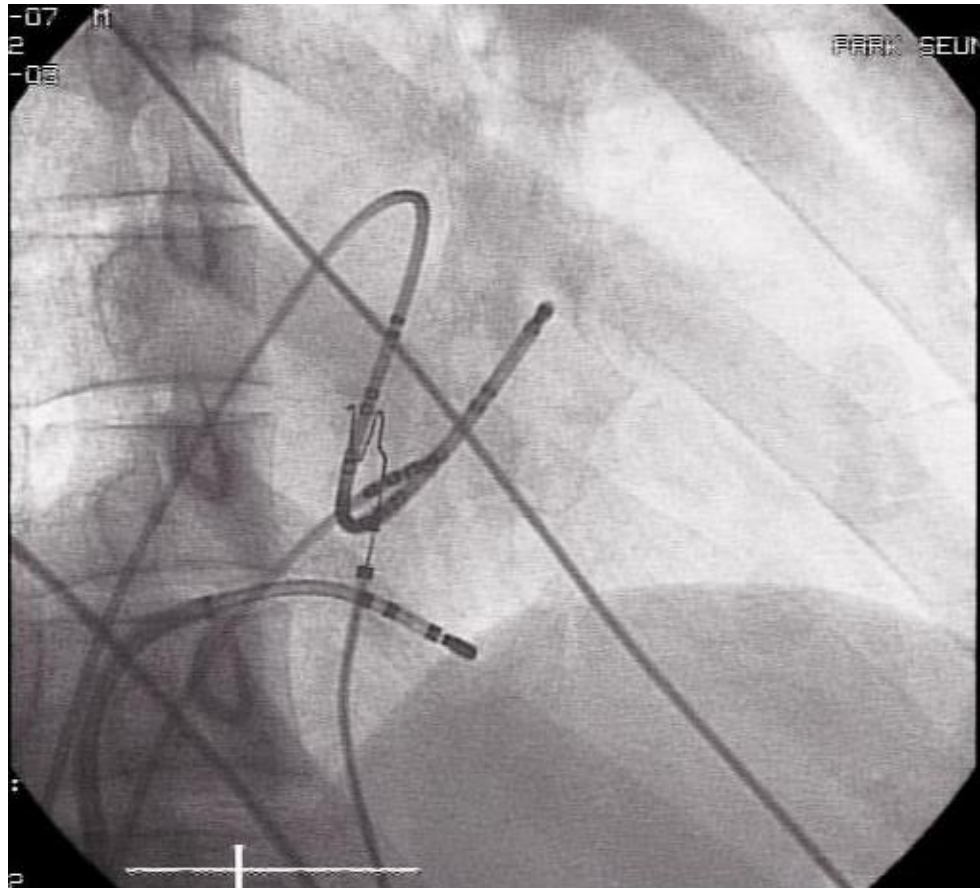
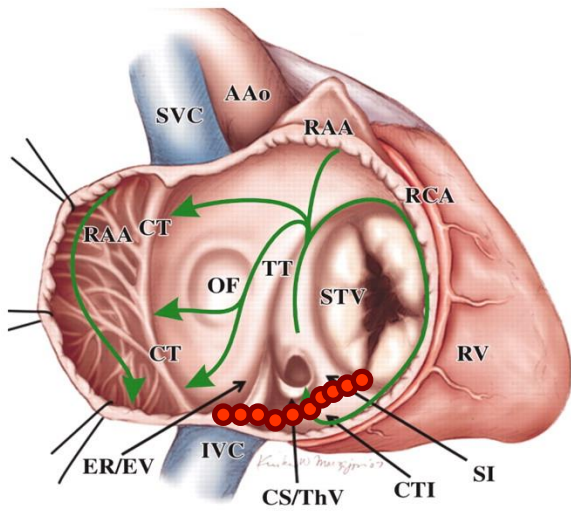
RIPV



LIPV



CTI ablation



Confirmation of PVI

RSPV



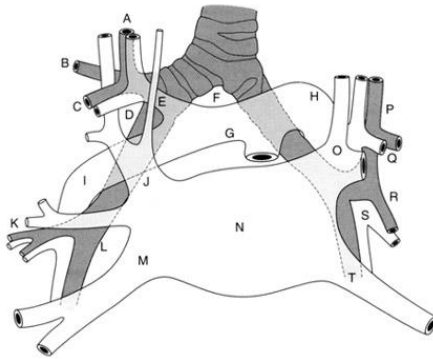
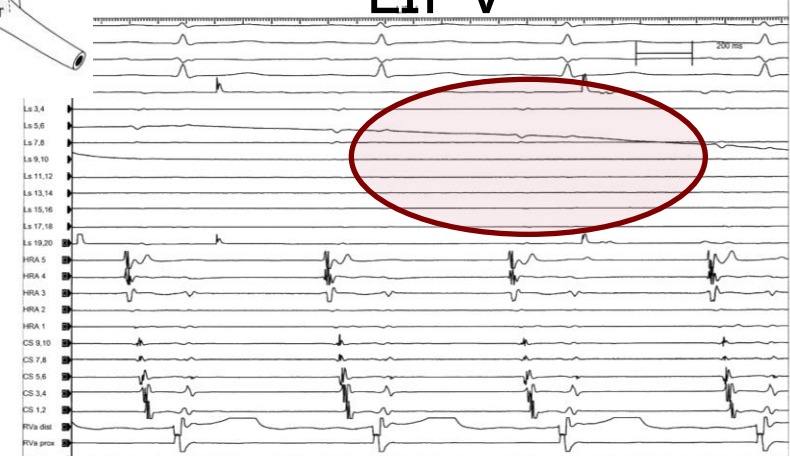
LSPV



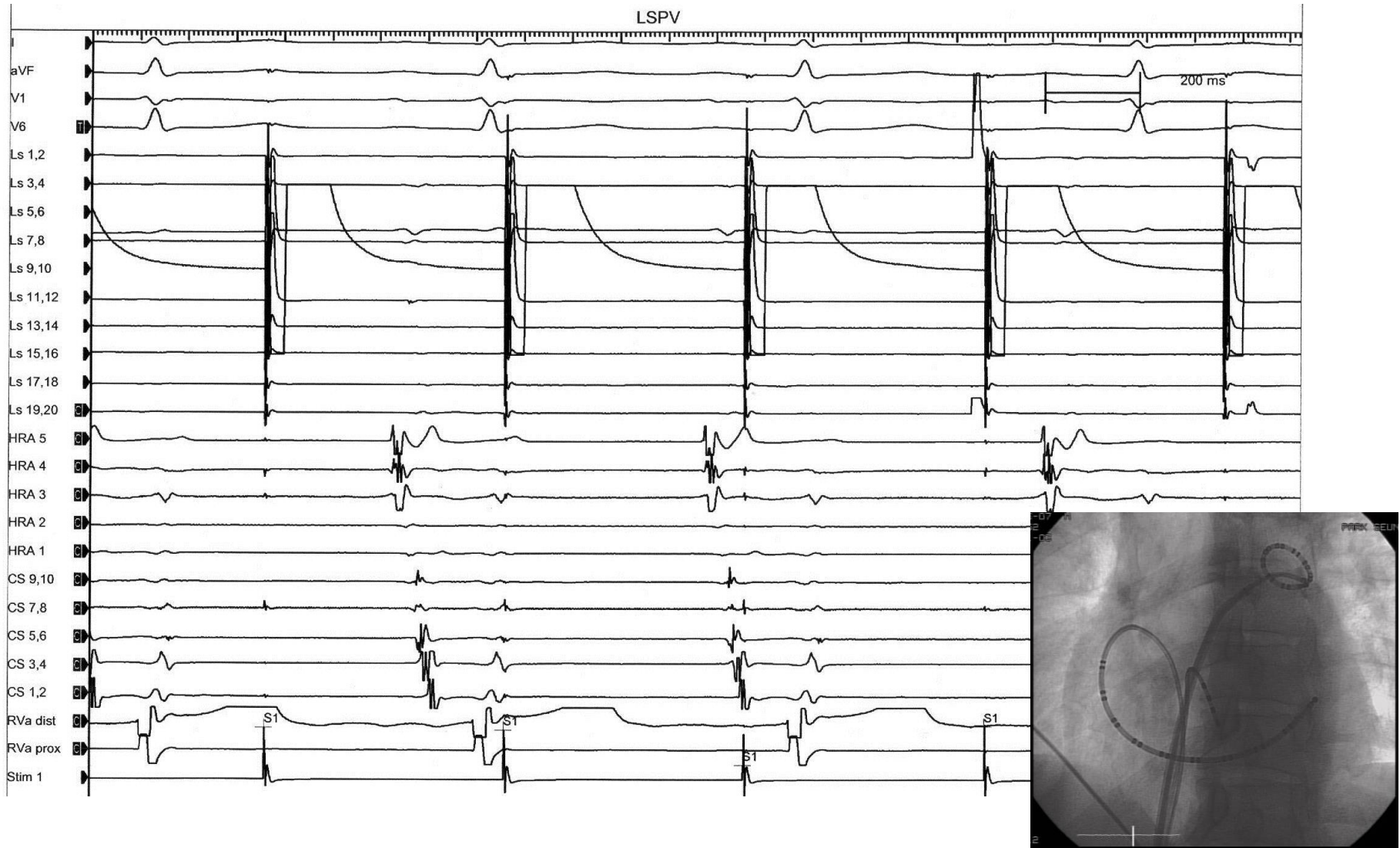
RIPV



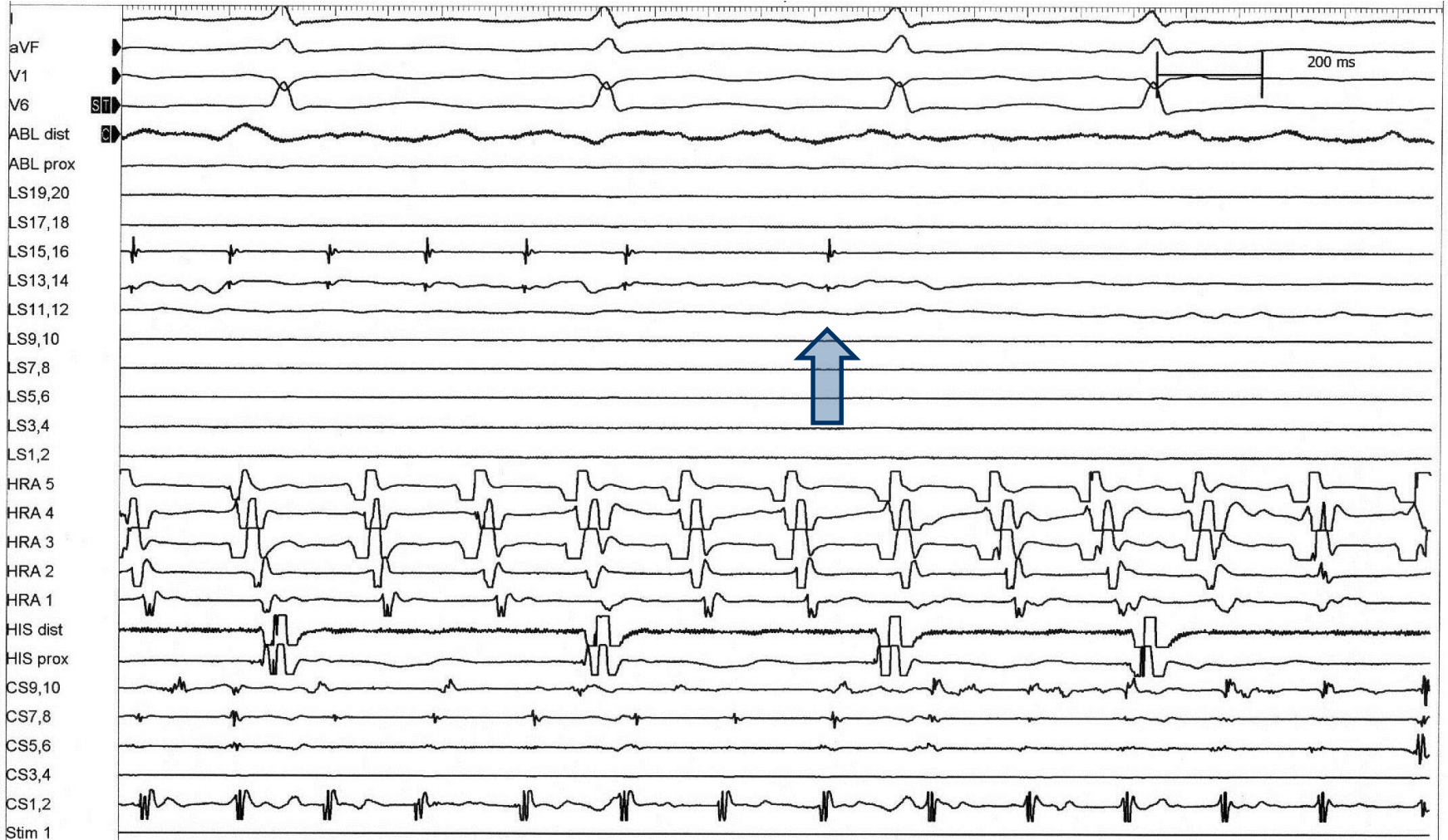
LIPV



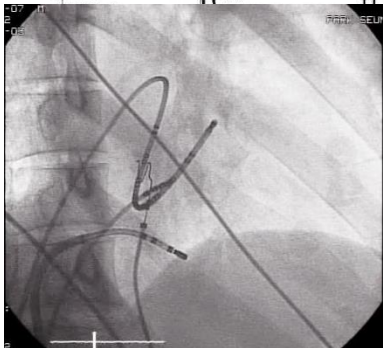
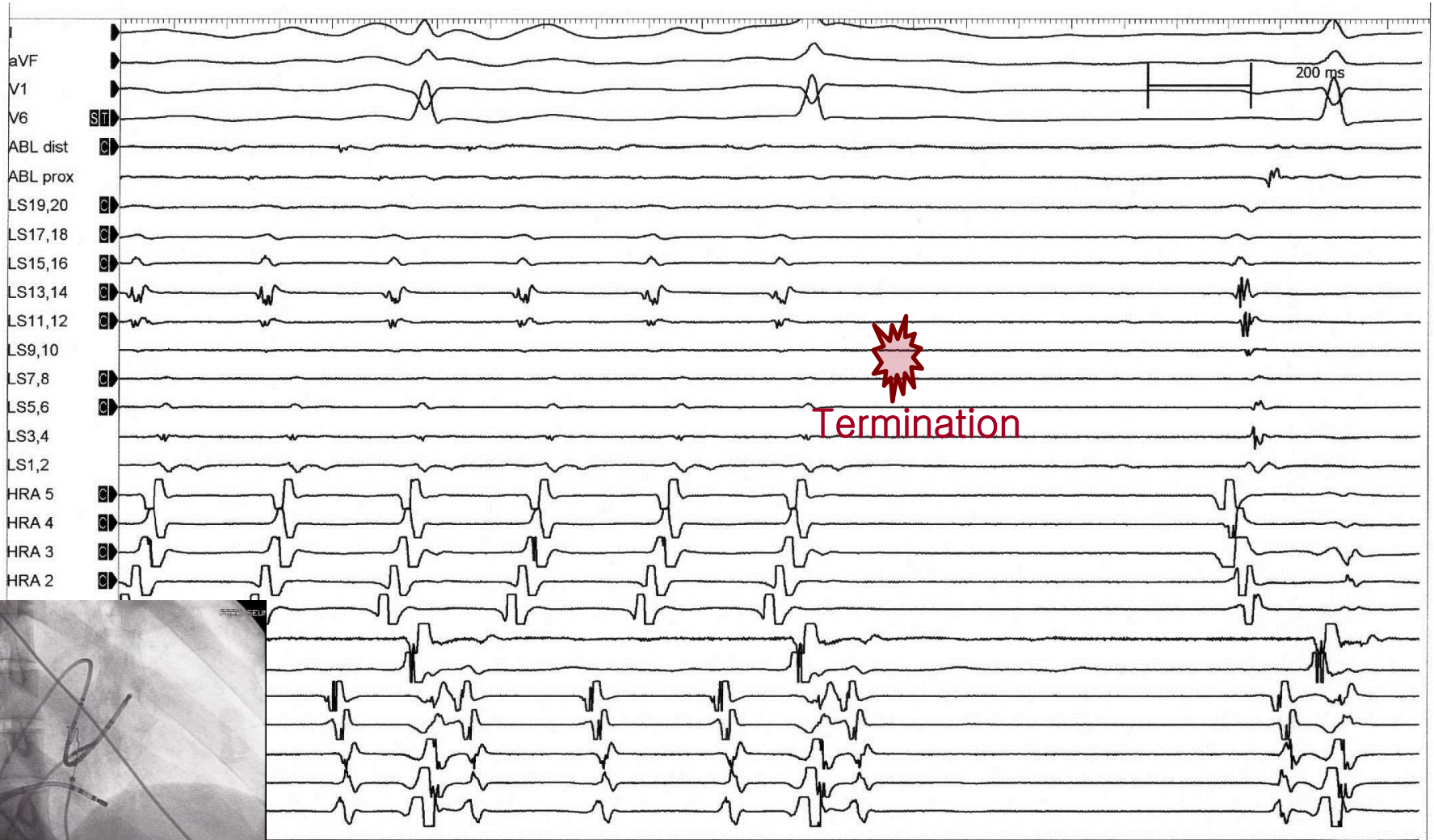
Exit block tests



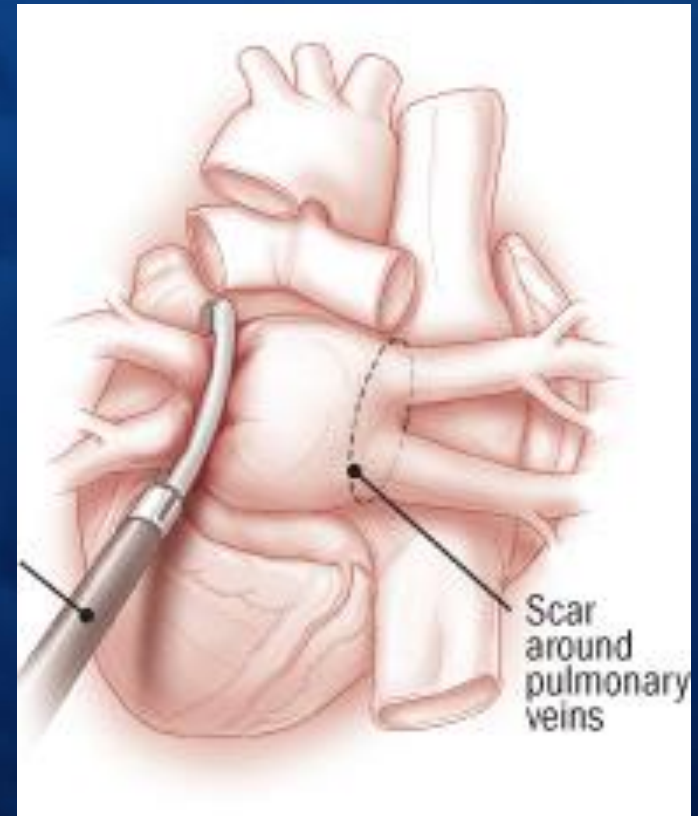
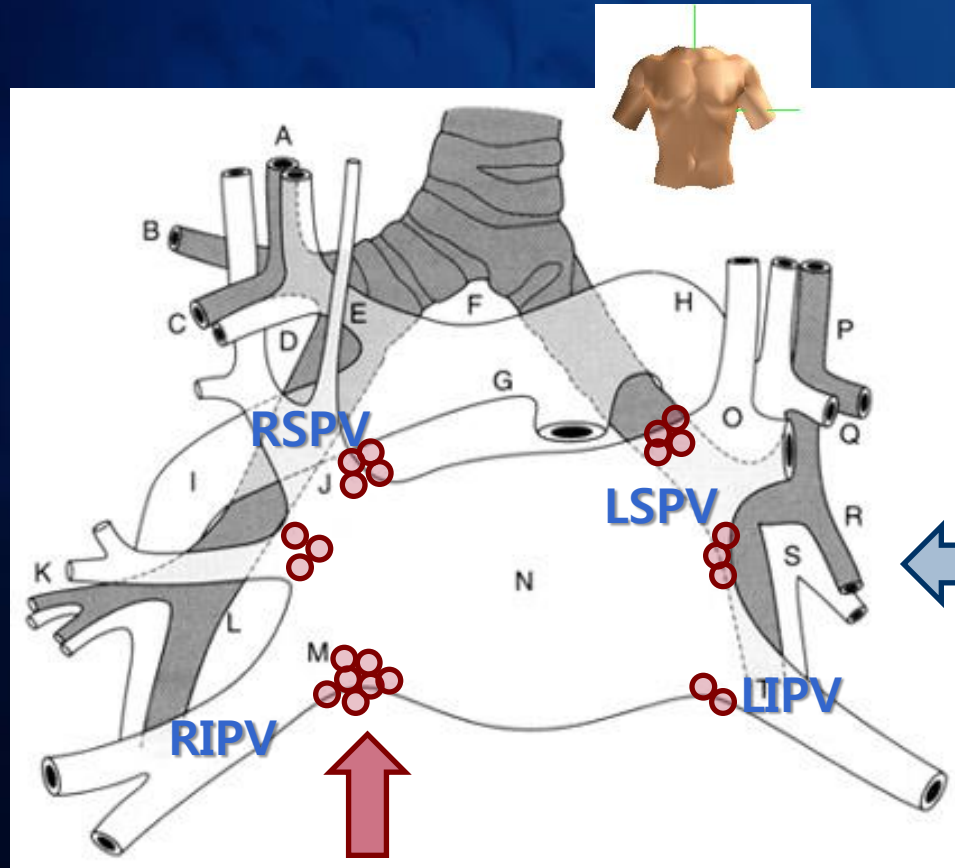
Ablation of residual PV potential



Termination of AFL during CTI ablation

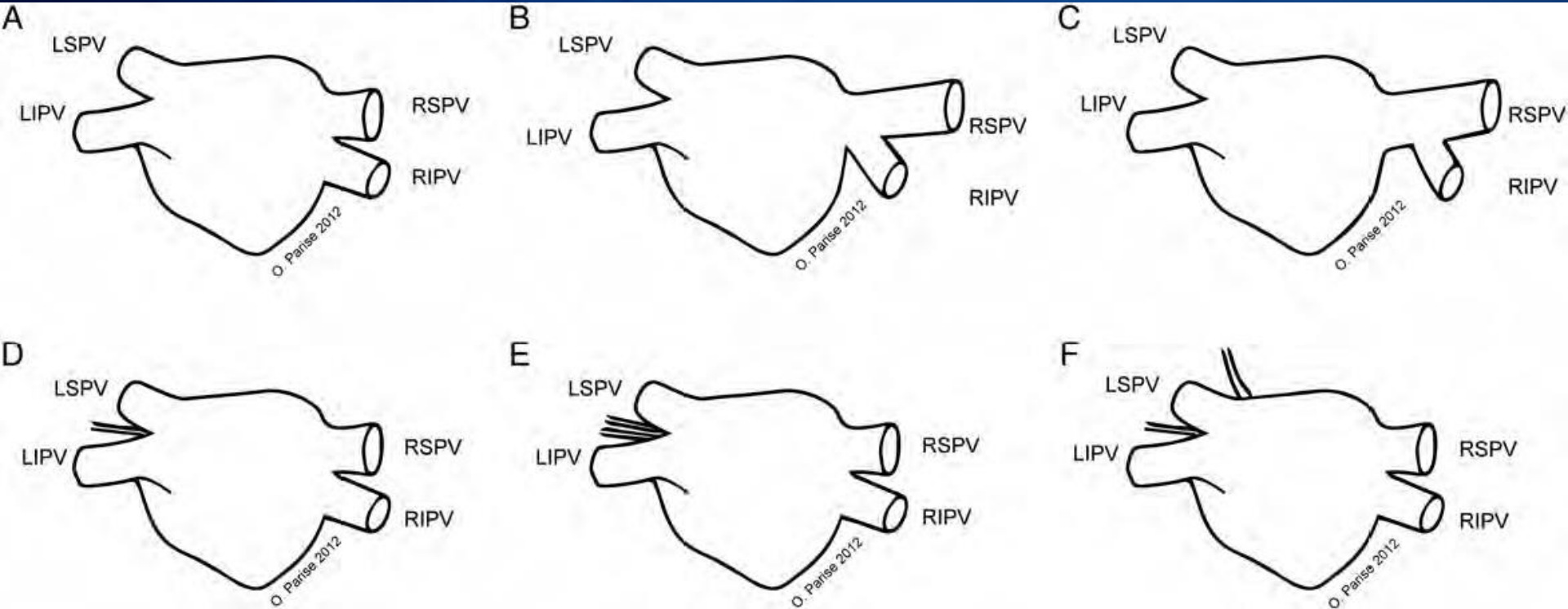


Additional endocardial ablation



n = 11 of 54 patients (20%)

Common patterns of PVs



Rhythm changes

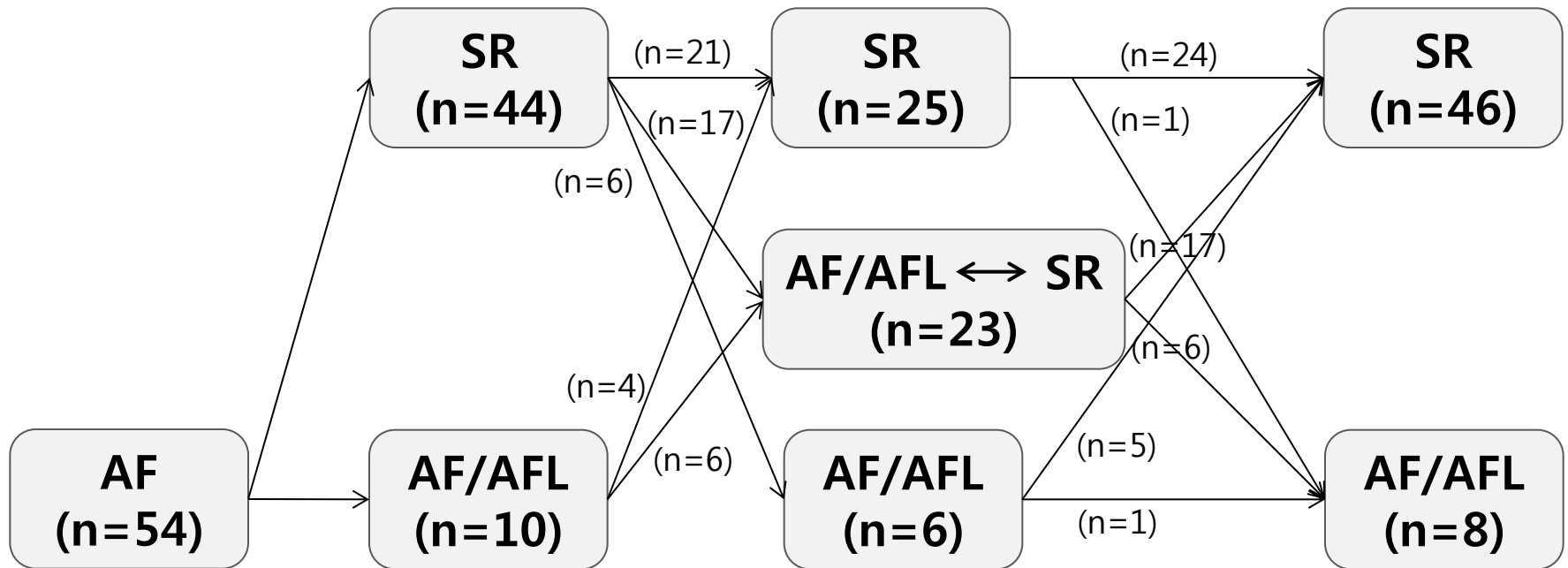
Baseline

Operation

Ward

EPS/RFCA

Discharge



Follow up



Discharge



Follow up
Every 3 months
– EKG



24 hours holter

- 6 months
- 12 months

Echocardiography

- 12 months



2 weeks event
after 12 months

Based on evaluation

- Stop anticoagulation
- Stop antiarrhythmic drugs

Another option for management of long persistent AF – Hybrid procedure

일시: 2014년 1월 10일(금) 08:30-15:00

장소: 삼성서울병원 별관 지하4층 Minimal Invasive Surgery Center(MIS)

일시: 2014년 1월 11일(토) 09:00-16:00

장소: 삼성서울병원 본관 지하1층 대강당

평점: 대한의사협회 5평점

2014. 1. 10(FRI)

08:30-15:00 **Animal Lab**

2014. 1. 11(SAT)

09:00-10:20 **Session I. HOW TO DO HYBRID PROCEDURE** 좌장: 온영근 (삼성서울병원 심장내과)
Tharumenthiran Ramanathan (Auckland City Hospital, New Zealand)

09:00-09:20 Current status of catheter ablation for AF

심재민 (고려대학교 안암병원 순화기내과)

09:20-09:40 Current status of antiarrhythmic surgery for AF

정재승 (고려대학교 안암병원 흉부외과)

09:40-10:00 Totally thorascopic ablation

Tharumenthiran Ramanathan (Auckland City Hospital, New Zealand)

10:00-10:20 Hybrid procedure

Joris R.de Groot (Amsterdam Medical Center, Netherlands)

10:20-10:40 *Coffee break*

10:40-12:20 **Session II. LIVE CASE** 좌장: Tharumenthiran Ramanathan (Auckland City Hospital, New Zealand)
양지혁 (삼성서울병원 흉부외과)

10:40-11:00 Postprocedural confirmation after TTA

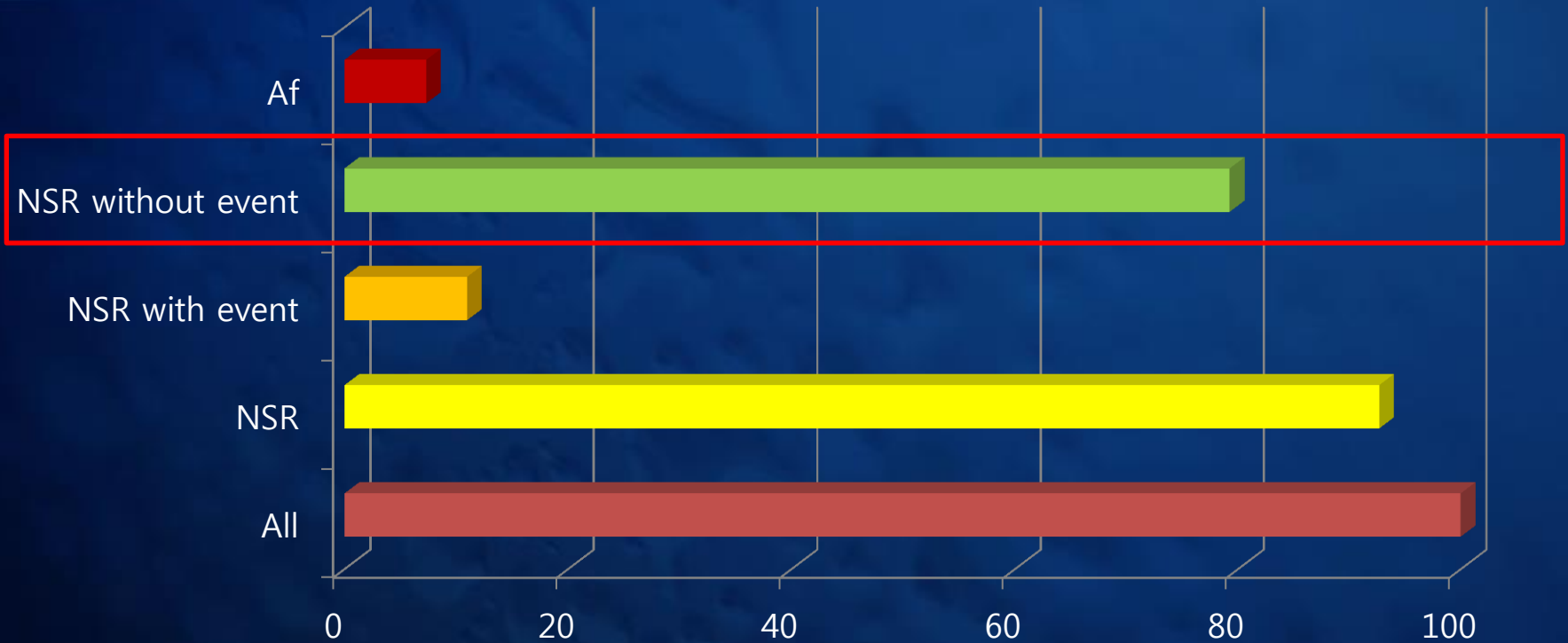
박승정 (삼성서울병원 심장내과)



SMC experiences for 3 years

Variables	N = 84
Age, y	55 years
Gender, male	78 (93%)
Persistent AF (long standing)	70 (83%)
Previous RFCA	11 (13%)
AF duration (documented), months	40 months
Congestive HF	6 (7%)
Stroke history	9 (11%)
Diabetes	11 (13%)
Hypertension	29 (35%)
CHAD > 1	17 (20%)

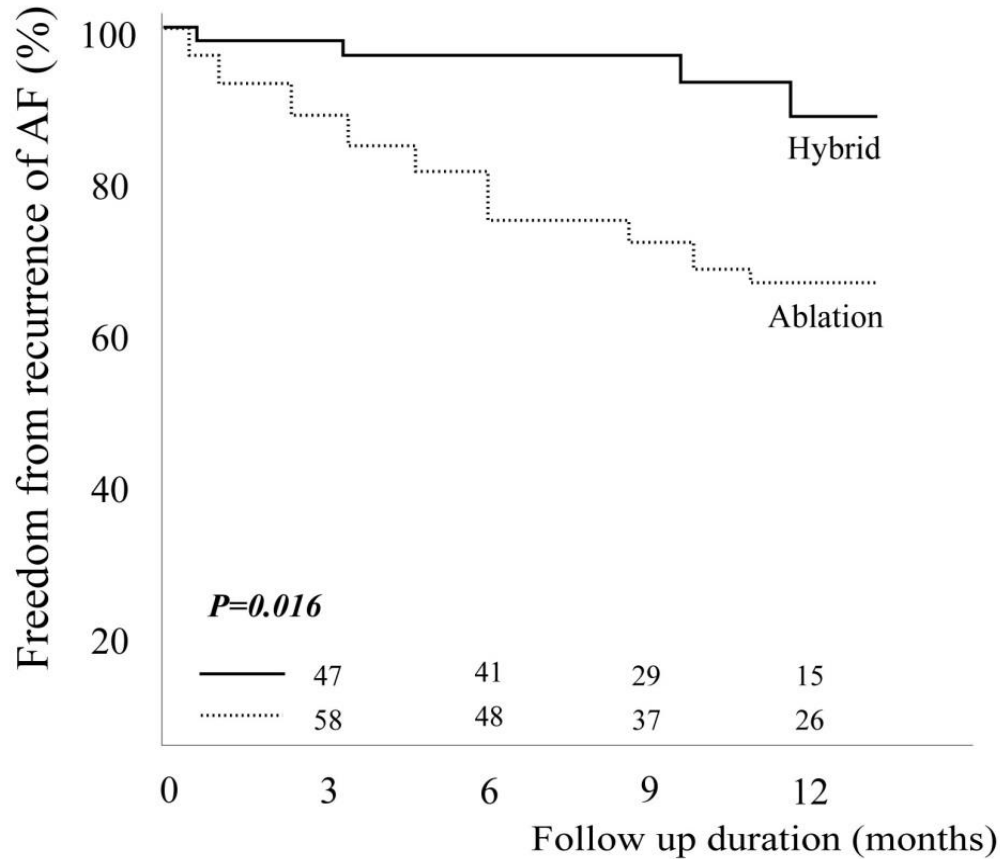
Results



	All	NSR	NSR with event	NSR without event	Af
계열1	100	92.68292683	10.97560976	79.26829268	7.317073171

RFCA versus Hybrid ablation

-persistent AF-



AF, atrial fibrillation.

Who are the Super-responders?

19.5%

	Super responder	Responder	Poor responder
Rhythm	Sinus	Sinus	ATA or AF
AAD	X	O	O
Warfarin	X	O or others	O
Left atrium	Reverse remodeling	Reverse remodeling	No change
Atrial activity	O	O or X	X
Recurred	X	O or X	O
No. of patients	16 ←	62 →	6

Glance at the future

- Mitral isthmus ablation
- True transmural lesion confirmation
- LA auricle exclusion
 - Endocardial versus epicardial
- Late recurrence management
- Atrial tachyarrhythmias
- Cost

Stand alone maze?

- Persistent atrial fibrillation
- Risk-benefit (esp. stroke)
- **Super-responders**
- Atrial reverse remodeling
- Restoration of atrial activity
- Consideration for later cardiac events
 - CABG, valve, aorta surgery.....

Thank you for your attention!!

